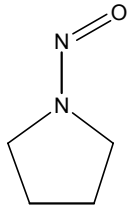
N-NITROSOPYRROLIDINE
CAS No. 930-55-2
First Listed in the *Second Annual Report on Carcinogens*



CARCINOGENICITY

N-Nitrosopyrrolidine is *reasonably anticipated to be a human carcinogen* based on sufficient evidence of carcinogenicity in experimental animals (IARC V.17, 1978; IARC S.4, 1982; IARC S.7, 1987). When administered in the drinking water, *N*-nitrosopyrrolidine induced lung adenomas in mice of both sexes, hepatocellular carcinomas, leukemia, cholangiocarcinomas, and olfactory carcinomas in rats of both sexes, and papillary mesotheliomas of the tunica vaginalis, interstitial cell tumors, and a cavernous hemangioma of the testis in male rats (IARC V.17, 1978).

There are no data available to evaluate the carcinogenicity of *N*-nitrosopyrrolidine in humans.

PROPERTIES

N-Nitrosopyrrolidine is a yellow liquid. It is miscible with water, soluble in organic solvents, and liquids. It decomposes in light and is especially sensitive to ultraviolet light. When heated to decomposition, it emits toxic fumes of nitrogen oxides (NO_x). It is oxidized by strong oxidants to corresponding nitramine. It can be reduced to the corresponding hydrazine and/or amine. It is resistant to hydrolysis.

USE

There is no evidence of commercial use of *N*-nitrosopyrrolidine. There is limited use for the compound in research (IARC V.17, 1978).

PRODUCTION

The Chem Sources USA directory identified one producer and nine suppliers of *N*-nitrosopyrrolidine in 1986 (Chem Sources, 1986). The 1979 TSCA Inventory identified one company producing 500 lb of *N*-nitrosopyrrolidine in 1977 (TSCA, 1979). No other production, import, or export data were available. Synthetic production of nitrosamines is limited to small quantities, primarily for use as research chemicals (HEEP No. 137, 1980).

EXPOSURE

The primary routes of potential human exposure to *N*-nitrosopyrrolidine are inhalation, ingestion, and dermal contact. There are no estimates available of the possible extent of human exposure to *N*-nitrosopyrrolidine. Exposure is probable when nitrite-preserved or -contaminated foods, especially fatty foods, are heat-prepared and ingested, since heating nitrite-treated foodstuffs may result in formation of *N*-nitrosopyrrolidine. The recent trend to decrease the concentration of sodium nitrite in food and use ascorbic acid as a substitute preservative has decreased exposure to *N*-nitrosopyrrolidine. For example, the *N*-nitrosopyrrolidine content of bacon decreased from about 67 µg/kg in 1971 through 1974 to only 17 µg/kg in 1975 and 1976; when bacon is fried, an average of 50% of the *N*-nitrosopyrrolidine normally present in that meat is found in the vapor. Dry premixed cures containing spices and sodium nitrite originally had *N*-nitrosopyrrolidine concentrations of 40 µg/kg, which increased to 520 µg/kg after six months of storage. Investigators have also found *N*-nitrosopyrrolidine in 50% of certain animal feeds at concentrations of 1-26 µg/kg, in tobacco smoke in amounts up to 0.113 µg/cigarette, and in the residue in pipe bowls (1.6 mg of *N*-nitrosopyrrolidine/kg of residue). In 1978, effluents from *N*-nitrosopyrrolidine production and manufacturing facilities contained *N*-nitrosopyrrolidine concentrations of 0.09-0.20 µg/L (IARC V.17, 1978).

N-Nitrosamines are produced frequently during rubber processing and may be present as contaminants in the final rubber products. Possible exposure is dependent on the ability of the nitrosamine to migrate from the product and enter the body. CPSC and FDA determined that the nitrosamines present in pacifiers can migrate from the pacifier into saliva and can, therefore, be ingested. Significant levels of *N*-nitroso compounds have been identified in a number of materials including pesticides, cosmetics, cutting fluids, and fire resistant hydraulic fluids. The *N*-nitroso compounds found in these products were apparently formed in situ during storage or handling as the result of a reaction between amines present in the mixture and inorganic nitrite, which may have been added as a corrosion inhibitor (CHIP, 1978). Using the "one-hit" model, it was estimated that the water concentration of *N*-nitrosopyrrolidine corresponding to a lifetime cancer risk of 10^{-5} is 0.11 µg/L, based on the induction of hepatocellular carcinomas in rats (HEEP, 1980).

REGULATIONS

EPA regulates *N*-nitrosopyrrolidine under the Clean Water Act (CWA), Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), and Resource Conservation and Recovery Act (RCRA). EPA published water quality criteria under CWA. EPA has established a reportable quantity (RQ) of 1 lb under CERCLA. *N*-Nitrosopyrrolidine is subject to report/recordkeeping requirements under RCRA. FDA regulates *N*-nitrosopyrrolidine under the Food, Drug, and Cosmetic Act (FD&CA), requiring separate packaging of spices and sodium nitrite in dry, premixed cures. This action resulted in a dramatic decrease in the *N*-nitrosopyrrolidine content of dry mixes. OSHA regulates *N*-nitrosopyrrolidine under the Hazard Communication Standard and as a chemical hazard in laboratories. Regulations are summarized in Volume II, Table B-111.